FCC Test Report

Report No.: AGC01680170101FE05

FCC ID : 2AKHJ-HW087

APPLICATION PURPOSE : Original Equipment

PRODUCT DESIGNATION: 2.4G Touchpad Keyboard

BRAND NAME : N/A

MODEL NAME : HW087

CLIENT: Shenzhen Hangshi Technology Co., Ltd.

DATE OF ISSUE : Mar. 10, 2017

STANDARD(S)

TEST PROCEDURE(S) : FCC Part 15 Rules

REPORT VERSION V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

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Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Mar. 10, 2017	Valid	Original Report

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1. VERIFICATION OF CONFORMITY

Applicant	Shenzhen Hastech Industries Co., Ltd.
Address	Hangshi Technology Park, Democracy West Industry Area, Shajing Town, Bao'an Distric, Shenzhen, China
Manufacturer	Shenzhen Hastech Industries Co., Ltd.
Address	Hangshi Technology Park, Democracy West Industry Area, Shajing Town, Bao'an Distric, Shenzhen, China
Product Designation	2.4G Touchpad Keyboard
Brand Name	N/A
Test Model	HW087
Date of test	Mar. 09, 2017 to Mar. 10, 2017
Deviation	None
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BR/RF

We hereby certify that:

The above equipment was tested by Dongguan Precise Testing Service Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC Rules Part 15.249.

Max Zhang(Zhang Yi) Mar. 10, 2017

Reviewed by

Bart Xie(Xie Xiaobin)) Mar. 10, 2017

Approved by

Solger Zhang(Zhang Hongyi) Mar. 10, 2017

Authorized Officer

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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

A major technical description of EUT is described as following

Operation Frequency	2.404 GHz to 2.479GHz	
Maximum field strength	90.05dBuV/m@3m(AV)	
Modulation	GFSK	
Number of channels	64	
Antenna Gain	0dBi	
Antenna Designation	Integrated Antenna (Met 15.203 Antenna requirement)	
Hardware Version	HW087 2.4G	
Software Version	V1.0	
Power Supply	DC 3V by battery	

2.2. TABLE OF CARRIER FREQUENCY

Channel Number	Frequency	Channel Number	Frequency	Channel Number	Frequency	Channel Number	Frequency
1	2404MHz	17	2423MHz	33	2442MHz	49	2461MHz
2	2405MHz	18	2424MHz	34	2443MHz	50	2462MHz
3	2406MHz	19	2425MHz	35	2444MHz	51	2466MHz
4	2407MHz	20	2426MHz	36	2445MHz	52	2467MHz
5	2408MHz	21	2427MHz	37	2446MHz	53	2468MHz
6	2409MHz	22	2428MHz	38	2450MHz	54	2469MHz
7	2410MHz	23	2429MHz	39	2451MHz	55	2470MHz
8	2411MHz	24	2430MHz	40	2452MHz	56	2471MHz
9	2412MHz	25	2434MHz	41	2453MHz	57	2472MHz
10	2413MHz	26	2435MHz	42	2454MHz	58	2473MHz
11	2414MHz	27	2436MHz	43	2455MHz	59	2474MHz
12	2418MHz	28	2437MHz	44	2456MHz	60	2475MHz
13	2419MHz	29	2438MHz	45	2457MHz	61	2476MHz
14	2420MHz	30	2439MHz	46	2458MHz	62	2477MHz
15	2421MHz	31	2440MHz	47	2459MHz	63	2478MHz
16	2422MHz	32	2441MHz	48	2460MHz	64	2479MHz

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3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y $\pm U$, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 % \circ

No.	Item	Uncertainty
1	Conducted Emission Test	±3.18dB
2	All emissions,radiated	±3.91dB
3	Temperature	±0.5°C
4	Humidity	±2%

4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX in GFSK modulation
2	Middle channel TX in GFSK modulation
3	High channel TX in GFSK modulation
Noto	

Note:

- 1. Only the result of the worst case was recorded in the report, if no other cases.
- 2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
- 3. The EUT had been programmed in continuous transmission conditions for the test modes.

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5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Configure 1:

EUT

5.2. EQUIPMENT USED IN EUT SYSTEM

Iten	Equipment	Model No.	ID or Specification	Remark
1	2.4G Touchpad Keyboard	HW087	2AKHJ-HW087	EUT

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.249	Radiated Emission	Compliant
§15.249	Band Edges	Compliant
§15.215	20dB bandwidth	Compliant

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6. TEST FACILITY

Site Dongguan Precise Testing Service Co., Ltd.		
Location Building D, Baoding Technology Park, Guangming Road2, Dongcheng District Dongguan, Guangdong, China.		
FCC Registration No.	371540	
Description	The test site is constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2014.	

ALL TEST EQUIPMENT LIST

Radiated Emission Test Site					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
EMI Test Receiver	Rohde & Schwarz	ESCI	101417	July 3, 2016	July 2, 2017
Trilog Broadband Antenna (25M-1GHz)	SCHWARZBECK	VULB9160	9160-3355	July 3, 2016	July 2, 2017
Signal Amplifier	SCHWARZBECK	BBV 9475	9745-0013	July 3, 2016	July 2, 2017
RF Cable	SCHWARZBECK	AK9515E	96221	July 3, 2016	July 2, 2017
3m Anechoic Chamber	CHENGYU	966	PTS-001	June 3, 2016	June 2, 2017
MULTI-DEVICE Positioning Controller	Max-Full	MF-7802	MF780208339	N/A	N/A
Active loop antenna (9K-30MHz)	Schwarzbeck	FMZB1519	1519-038	June 3, 2016	June 2, 2017
Spectrum analyzer	Agilent	E4407B	MY46185649	June 3, 2016	June 2, 2017
Horn Antenna (1G-18GHz)	SCHWARZBECK	BBHA9120D	9120D-1246	June 3, 2016	June 2, 2017
Horn Ant (18G-40GHz)	Schwarzbeck	BBHA 9170	9170-181	June 3, 2016	June 2, 2017

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7. RADIATED EMISSION

7.1TEST LIMIT

Standard FCC15.249

Fundamental Frequency	Field Strength of Fundamental	Field Strength of Harmonics	
	(millivolts/meter)	(microvolts/meter)	
900-928MHz	50	500	
2400-2483.5MHz	50	500	
5725-5875MHz	50	500	
24.0-24.25GHz	250	2500	

Standard FCC 15.209

Frequency	Distance	Field	Strengths Limit			
(MHz)	Meters	μ V/m	dB(μV)/m			
0.009 ~ 0.490	300	2400/F(kHz)				
0.490 ~ 1.705	30	24000/F(kHz)				
1.705 ~ 30	30	30				
30 ~ 88	3	100	40.0			
88 ~ 216	3	150	43.5			
216 ~ 960	3	200	46.0			
960 ~ 1000	3	500	54.0			
Above 1000	3	Other:74.0 dB(µV)/m	Other:74.0 dB(µV)/m (Peak) 54.0 dB(µV)/m (Average)			

Remark:

- (1) Emission level dB μ V = 20 log Emission level μ V/m
- (2) The smaller limit shall apply at the cross point between two frequency bands.
- (3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

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7.2. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.

- 2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
- 3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
- 4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
- 5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
- 6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- 7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
- 8.If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the guasi-peak method for below 1GHz.
- 9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- 10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High Low scan is not required in this case.

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The following table is the setting of spectrum analyzer and receiver.

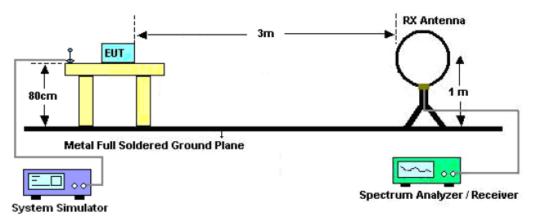
Spectrum Parameter	Setting		
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP		
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP		
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP		
Start ~Stop Frequency	1GHz~26.5GHz 1MHz/1MHz for Peak, 1MHz/10Hz for Average		

Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

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7.3. TEST SETUP

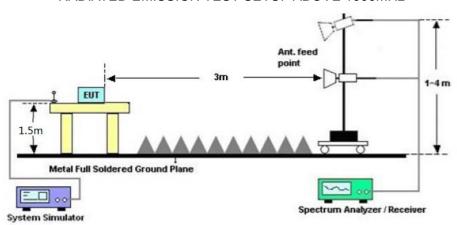
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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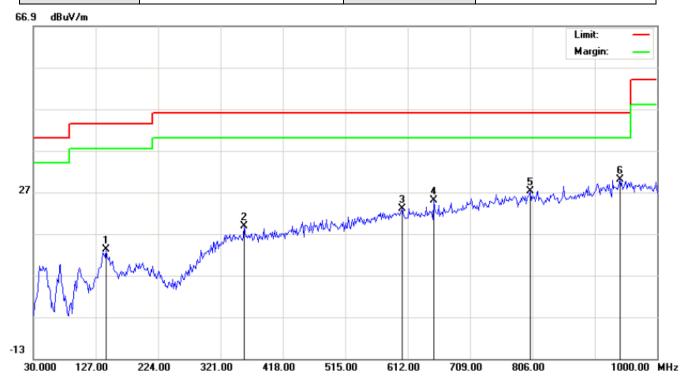
7.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz.

RADIATED EMISSION 30MHz-1GHZ

EUT:	2.4G Touchpad Keyboard	Model Name. :	HW087
Temperature:	20 ℃	Relative Humidtity:	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 1	Polarization :	Horizontal

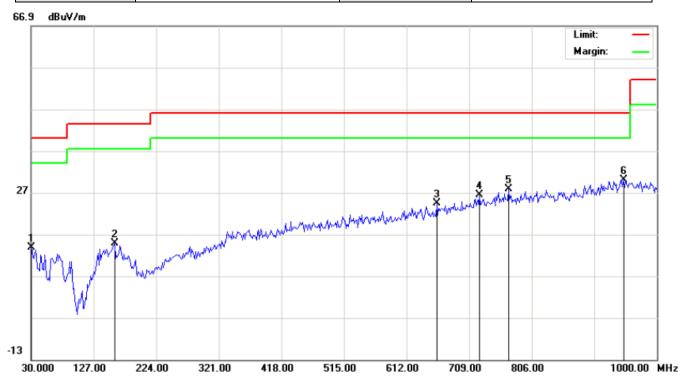


No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height		Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		143.1667	-1.30	14.43	13.13	43.50	-30.37	peak			
2		358.1833	-0.04	18.79	18.75	46.00	-27.25	peak			
3		603.9167	-0.72	23.74	23.02	46.00	-22.98	peak			
4		652.4167	1.00	23.91	24.91	46.00	-21.09	peak			
5		802.7667	-0.05	27.32	27.27	46.00	-18.73	peak			
6	*	941.8000	0.27	29.77	30.04	46.00	-15.96	peak			

RESULT: PASS

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EUT:	2.4G Touchpad Keyboard	Model Name. :	HW087
Temperature:	20 ℃	Relative Humidtity:	48%
Pressure:	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 1	Polarization:	Vertical



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height		Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		30.0000	18.02	-4.20	13.82	40.00	-26.18	peak			
2		159.3333	-0.55	15.33	14.78	43.50	-28.72	peak			
3		658.8832	0.23	24.09	24.32	46.00	-21.68	peak			
4		725.1667	0.45	25.91	26.36	46.00	-19.64	peak			
5		770.4333	0.88	26.91	27.79	46.00	-18.21	peak			
6	*	948.2667	0.10	29.95	30.05	46.00	-15.95	peak			

RESULT: PASS

Note:

Factor=Antenna Factor + Cable loss, Margin=Result-Limit.

The "Factor" value can be calculated automatically by software of measurement system.

The mode 1 is the worst case, and only the data of the worst case recorded in this test report.

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RADIATED EMISSION ABOVE 1GHZ

EUT:	2.4G Touchpad Keyboard	Model Name. :	HW087
Temperature:	20 ℃	Relative Humidtity:	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 1	Polarization :	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
2404.013	103.54	-9.37	94.17	114	-19.83	peak
2404.013	99.42	-9.37	90.05	94	-3.95	AVG
4808.026	50.44	3.74	54.18	74	-19.82	peak
4808.026	46.27	3.74	50.01	54	-3.99	AVG
7212.039	42.11	8.14	50.25	74	-23.75	peak
7212.039	37.92	8.14	46.06	54	-7.94	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT:	2.4G Touchpad Keyboard	Model Name. :	HW087
Temperature:	20 ℃	Relative Humidtity:	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 1	Polarization :	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type	
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type	
2404.013	100.48	-9.37	91.11	114	-22.89	peak	
2404.013	96.38	-9.37	87.01	94	-6.99	AVG	
4808.026	49.25	3.74	52.99	74	-21.01	peak	
4808.026	45.33	3.74	49.07	54	-4.93	AVG	
7212.039	41.82	8.14	49.96	74	-24.04	peak	
7212.039 37.45 8.14 45.59 54 -8.41 AVG							
Remark:							
Factor = Ante	nna Factor + C	able Loss – Pr	e-amplifier.			·	

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EUT:	2.4G Touchpad Keyboard	Model Name. :	HW087
Temperature:	20 ℃	Relative Humidtity:	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 2	Polarization :	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
2442.016	103.12	-9.63	93.49	114	-20.51	peak
2442.016	98.86	-9.63	89.23	94	-4.77	AVG
4884.032	48.75	3.76	52.51	74	-21.49	peak
4884.032	44.56	3.76	48.32	54	-5.68	AVG
7326.048	41.87	8.17	50.04	74	-23.96	peak
7326.048	37.66	8.17	45.83	54	-8.17	AVG
Remark:						
Factor = Ante	Factor = Antenna Factor + Cable Loss – Pre-amplifier.					

EUT:	2.4G Touchpad Keyboard	Model Name. :	HW087
Temperature:	20 ℃	Relative Humidtity:	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 2	Polarization :	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
2442.016	100.08	-9.63	90.45	114	-23.55	peak
2442.016	95.72	-9.63	86.09	94	-7.91	AVG
4884.032	48.25	3.76	52.01	74	-21.99	peak
4884.032	43.96	3.76	47.72	54	-6.28	AVG
7326.048	41.54	8.17	49.71	74	-24.29	peak
7326.048	37.39	8.17	45.56	54	-8.44	AVG
Remark:						
ootor - Anto	onna Factor + C	abla Laga Di	o amplifior			

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

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EUT:	2.4G Touchpad Keyboard	Model Name. :	HW087
Temperature :	20 ℃	Relative Humidtity:	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 3	Polarization :	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
2479.021	102.97	-9.61	93.36	114	-20.64	peak
2479.021	98.58	-9.61	88.97	94	-5.03	AVG
4958.042	46.38	3.83	50.21	74	-23.79	peak
4958.042	42.27	3.83	46.1	54	-7.9	AVG
7437.063	40.85	8.21	49.06	74	-24.94	peak
7437.063	36.62	8.21	44.83	54	-9.17	AVG
Remark:						
Factor = Ante	Factor = Antenna Factor + Cable Loss – Pre-amplifier.					

EUT:	2.4G Touchpad Keyboard	Model Name. :	HW087
Temperature :	20 ℃	Relative Humidtity:	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 3	Polarization :	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
2479.021	100.12	-9.61	90.51	114	-23.49	peak
2479.021	95.94	-9.61	86.33	94	-7.67	AVG
4958.042	45.78	3.83	49.61	74	-24.39	peak
4958.042	41.63	3.83	45.46	54	-8.54	AVG
7437.063	40.68	8.21	48.89	74	-25.11	peak
7437.063 36.51 8.21 44.72 54 -9.28 AVG						
Remark:						
Factor = Ante	enna Factor + C	Factor = Antenna Factor + Cable Loss – Pre-amplifier.				

Note: Other emissions from 8G to 25 GHz are considered as ambient noise. No recording in the test report. Factor=Antenna Factor + Cable loss - Amplifier gain, Margin=Measurement-Limit.

The "Factor" value can be calculated automatically by software of measurement system.

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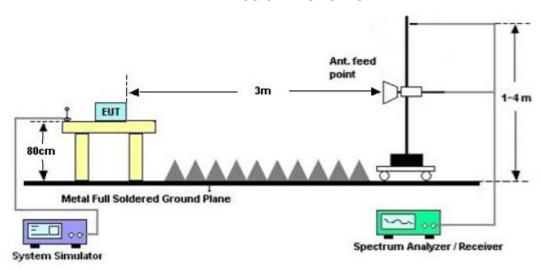
8. BAND EDGE EMISSION

8.1. MEASUREMENT PROCEDURE

- 1. The EUT operates at transmitting mode. The operate channel is tested to verify the largest transmission and spurious emissions power at the continuous transmission mode.
- 2. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission: (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
- (b) AVERAGE: RBW=1MHz; VBW=1/on time(1KHz) / Sweep=AUTO
- 3. Other procedures refer to clause 7.2.

8.2 TEST SETUP

RADIATED EMISSION TEST SETUP



8.3 RADIATED TEST RESULT

Note:

- 1. Factor=Antenna Factor + Cable loss Amplifier gain. Field Strength=Factor + Reading level
- 2. The factor had been edited in the "Input Correction" of the Spectrum Analyzer. So the Amplitude of test plots is equal to Reading level plus the Factor in dB. Use the A dB(μ V) to represent the Amplitude. Use the F dB(μ V/m) to represent the Field Strength. So A=F.

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EUT:	2.4G Touchpad Keyboard	Model Name. :	HW087
Temperature :	20 ℃	Relative Humidtity:	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 1	Polarization :	Horizontal

PK Value



AV Value



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EUT:	2.4G Touchpad Keyboard	Model Name. :	HW087
Temperature:	20 ℃	Relative Humidtity:	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 1	Polarization :	Vertical

PK Value



AV Value



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EUT:	2.4G Touchpad Keyboard	Model Name. :	HW087
Temperature:	20 ℃	Relative Humidtity:	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 3	Polarization :	Horizontal

PK Value



AV Value



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EUT:	2.4G Touchpad Keyboard	Model Name. :	HW087
Temperature :	20 ℃	Relative Humidtity:	48%
Pressure :	1010 hPa	Test Voltage :	DC3V
Test Mode :	Mode 3	Polarization :	Vertical

PK Value



AV Value



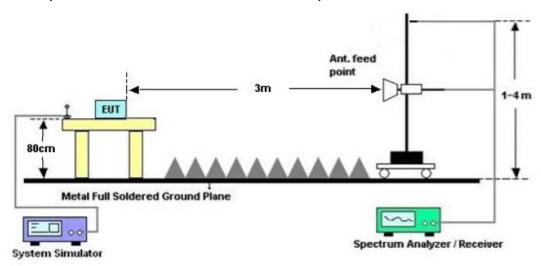
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9. 20DB BANDWIDTH

9.1. MEASUREMENT PROCEDURE

- 1. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
- 2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- 3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hoping channel
 The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video
 bandwidth (VBW) shall be approximately three times RBW; Sweep = auto; Detector function = peak
- 4. Set SPA Trace 1 Max hold, then View.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



9.3. MEASUREMENT RESULTS

TEST ITEM	20DB BANDWIDTH
TEST MODE	Mode1;Mode2;Mode3

Test Data (MHz)		Criteria
Low Channel	0.8522	PASS
Middle Channel	0.9223	PASS
High Channel	0.9502	PASS

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TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



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TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

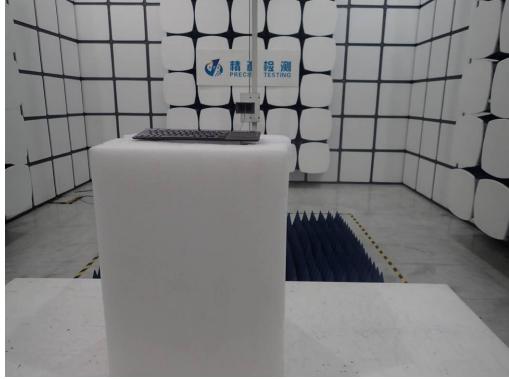


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APPENDIX A: PHOTOGRAPHS OF TEST SETUP

FCC RADIATED EMISSION TEST SETUP





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APPENDIX B: PHOTOGRAPHS OF EUT

TOP VIEW OF EUT



BOTTOM VIEW OF EUT



FRONT VIEW OF EUT



BACK VIEW OF EUT



LEFT VIEW OF EUT



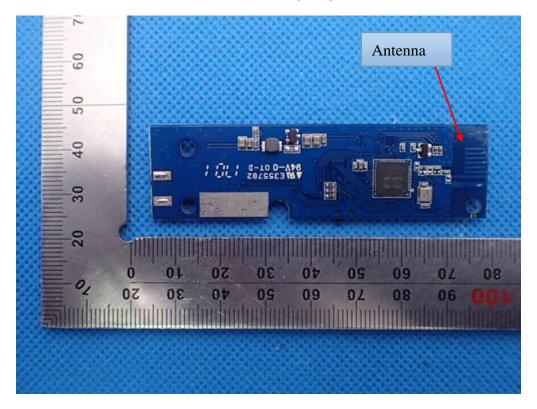
RIGHT VIEW OF EUT



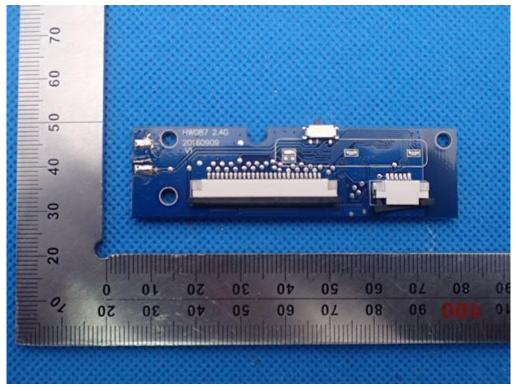
OPEN VIEW OF EUT



INTERNAL VIEW OF EUT-1



INTERNAL VIEW OF EUT-2



----END OF REPORT----